



## Review Article

# Prevalence of type 2 diabetes mellitus in Africa: an updated narrative review

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## Abstract

This review focused on data on the prevalence of diabetes mellitus especially type 2 diabetes mellitus (T2DM) in Africa, where the current number of diabetes individuals has reached 19 million. There appears to be heterogeneity in the data between countries with a trend towards the development of diabetes at an earlier age, high socio-economic impact but also limited financial resources given that the majority of African countries are developing countries with low to middle income. Africa is not spared the universal risk factors for T2DM, but the influence of the environment (urbanization), inadequate diets and sedentary lifestyle, often leading to overweight and obesity, remains a major concern. This is reflected in projections and estimates by the International Diabetes Federation (IDF), which predicts a 143% increase in the number of people with diabetes in Africa by 2045. Other factors have a negative impact on diabetes management, such as difficult access to medication and lack of education programs. Overall and individual awareness raising in collaboration with health authorities, governments and the media remains the most appropriate. Pending the implementation of national programs for the prevention of diabetes and its complications, it is necessary to strengthen therapeutic education and improve the quality of primary care in order to fight the scourge of diabetes.

**Keywords:** Type 2 diabetes mellitus, epidemiology, prevalence, risk factors, Africa.

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## 1. Introduction

Diabetes mellitus remains a major public health issue worldwide. Africa and its emerging countries are sharing with the rest of the world this galloping and worrying increase in the number of diabetic patients. Indeed, the IDF in its latest edition of 2019 <sup>1</sup> showed that more than 19 million people in Africa have diabetes (without North Africa). This number will increase by 143% by 2045, which is the largest projected increase compared to other IDF regions (Table 1). The number of undiagnosed people with diabetes in Africa is the highest proportion compared to other regions of the world, with 3 out of 5 people living with diabetes unaware being affected by the disease (Table 1). Diabetes and its complications represent a real public health issue with socio-economic repercussions and a very significant cost. Diabetes in Africa will cause 366,200 deaths in 2019 <sup>1</sup>.

An analysis of epidemiological data and complications in the Middle East and North Africa (MENA) region <sup>2</sup> has suggested that more ways of obtaining more epidemiological data and more representative information are needed to better understand diabetes management and to undertake more appropriate diabetes prevention and control programs.

Risk factors for developing type 2 diabetes mellitus are disparate across the world with differences reported in Africa, making prevention approaches not yet optimized in developing countries. The demographic and epidemiological transitions in

Africa, with undoubtedly increased life expectancy, have also led to the emergence of chronic non-communicable diseases <sup>1</sup>.

## 2. Epidemiological data in progress

The insidious evolution and asymptomatic nature of T2DM often make it difficult to conduct epidemiological studies. It is therefore tremendously difficult to compare studies with each other, given the methodological differences (sample, diagnostic methods used, target population, study period and region studied).

The current number of people with diabetes in the world aged 20-79 years is 463 million and will increase to 578 million and 700 million in 2030 and 2045 respectively, with a 51% increase in the number of cases <sup>1</sup>. In Africa, the prevalence of diabetes, estimated by the IDF at 3.9% (2.1-7.1) differs between countries <sup>1</sup>. It should just be noted that the geographical distribution of IDF Africa includes North Africa in the MENA region. As such, the prevalence figures for North Africa have been added in Table 2. Those most affected by the diabetes epidemic are South Africa (4.6 million), Nigeria (2.7 million), the Democratic Republic of the Congo (1.8 million), Ethiopia (1.7 million) and the United Republic of Tanzania (1.0 million). The overall prevalence of diabetes, reported in studies conducted in West Africa, was 6.2%<sup>3</sup>. This increase, over time in the prevalence of T2DM, is evident when comparing the IDF Atlas figures from 2000/2003 to 2019, as shown in Table 3 <sup>1,4,5</sup>.

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Data from 12 national population-based surveys in sub-Saharan Africa, representing 38,311 people, reported a diabetes prevalence of 5% (2-14%) <sup>6</sup>.

Comparing Africa and the MENA region (including North Africa) with the rest of the world, these two regions will experience the largest increase in the number of patients with diabetes, with a raise in cases of 143% and 96% respectively (see Table 2). This increase in diabetes prevalence is supported by all IDF data published from 2000 to 2019 <sup>1,4,5,8-12</sup>.

Of the 19 million Africans aged 20-79 with diabetes, 60% are unknown, the highest proportion worldwide, according to the IDF <sup>1</sup>.

IDF has used several sources for diabetes prevalence data, the majority of which are either from peer-reviewed publications or

of resources in relation to the desired needs remain fairly below true estimates. According to the IDF, diabetes-related healthcare spending in 2017 is estimated at \$3.3 billion in total. In Nigeria, the annual national direct costs of diabetes were estimated between \$1.071 billion and \$1.639 billion, while in Cameroon, the direct medical costs, per individual per month, were estimated at \$148. In Sudan, the cost of drugs and outpatient care was \$175 per year <sup>15</sup>. Furthermore, in a recent literature review (2006-2016) the annual national direct costs of diabetes varied from country to country and ranged from \$3.5 billion to \$4.5 billion per year <sup>1,16</sup>. In contrast to the high death rate in the MENA region, estimated at 10%, little expenditure is attributed to diabetes <sup>8,17</sup>.

**Table 1:** IDF projections (2019-2030-2045) among the population aged 20-79 years. IDF 2019 <sup>1</sup>

		World	Europe	Western Pacific	North America & Caribbean	South & Central America	South-East Asia	Middle East & North Africa	Africa
<b>Diabetics (million)</b>	<b>2019</b>	463	59	163	48	32	88	55	19
	<b>2030</b>	578	66	197	56	40	115	76	29
	<b>2045</b>	700	68	212	63	49	153	55	47
<b>Percentage of increase</b>		51 %	15%	31%	33%	55%	74%	96%	143%
<b>Diabetes undiagnosed</b>		1/2				2/5			3/5
<b>Death due to diabetes under 60 years</b>								1/2	3/4

national health surveys, with some regions using surveys conducted with the World Health Organization (WHO) as part of the STEPwise surveys. Further sources were also used if they contained sufficient information. This may be partly behind the underestimated prevalence figures of the IDF. Moreover, before the publication of the new ATLAS, a data collection is requested from all countries across their regions.

Focusing on North Africa, WHO STEPwise surveys were conducted during 2016-2017 and the prevalence rates were significantly higher than the latest IDF estimates, with 14.4% in Algeria, 9.8% in Tunisia and 10.6% in Morocco. Using Algeria as an example, the 2016-2017 WHO STEPwise survey was conducted throughout the country, reaching 7,450 people and considering geographical differences (Littoral, Highlands and Southern Region) <sup>13</sup>. As a reminder, the first STEPwise survey, carried out in Algeria, dates back to 2003 and involved two districts (Setif and Mostaganem) <sup>14</sup>. Taking into consideration the risk factors for diabetes and their progression, this finding between the 2 STEPwise surveys in Algeria recorded an 80% increase in diabetes within 15 years (8.9% in 2003 vs. 14.4% in 2017), which is quite plausible, given the absence of a prevention policy to date. The expenditure allocated to diabetes in Africa (US\$ 9.5 billion) represents less than 1% of global expenditure <sup>1</sup>. Indeed, expenditures related to diabetes management and the imbalance

### 3. What are the epidemiological characteristics of Africa?

There is a great deal of heterogeneity across studies in relation to gender, age, and sample size, depending on the diagnosis and between data collection methods. Most data, particularly in North Africa, are from small studies that use non-standardized measures. Cohort studies are seldom conducted <sup>18</sup>.

Africa and the Maghreb countries have experienced a real epidemic of T2DM, with a rapid epidemiological and demographic transition <sup>19</sup>. An article, published in 2014 on the situation of diabetes in Africa, reported that this disease, once considered rare, has experienced a real resurgence <sup>20</sup>. It can also be pointed out that between developed and developing countries, the age of onset of diabetes is relatively young in Africa. Among the majority of T2DM under 60 years of age (43.2%), the highest proportion is between 40-59 years of age <sup>20</sup>. The consequences of complications on morbidity and mortality and socioeconomic impact will not be inconsequential. Diabetes is responsible for the highest age-specific mortality rate in the world <sup>21,22</sup>. Based on the IDF 2019 Atlas, 3 out of 4 deaths, due to diabetes, occur in people younger than 60 years of age, with the highest proportion of Africans being under 60 years of age in the IDF regions <sup>1</sup>.

In sub-Saharan Africa, which is considered as a low- and middle-income region, the burden of diabetes remains very high due to socio-economic (urbanization), nutritional (high-calorie diet, overweight and obesity) and sedentary lifestyle changes. This is exacerbated by insufficient development of health care systems and lack of educational programs <sup>23</sup>. An analysis of about 40 observational studies in sub-Saharan African countries found that patients rarely self-monitoring their blood glucose, were physically active for low frequency/duration, had moderate adherence to diet and recommended treatments, and were unaware of the complications of diabetes. The utilization of traditional or herbal medications remains also an important practice to consider <sup>24</sup>.

The age of onset of T2DM is earlier. The prevalence of unknown diabetes on average of 50.7% is still high and is much higher in low-income countries. In a systematic survey, conducted in several African countries, including North Africa, the proportion of unknown diabetics varied between 18% and 75% <sup>25</sup>. This leads to late diagnosis with the development of complications at the time of diagnosis of T2DM <sup>10,26</sup>.

Sub-Saharan African countries also have their characteristics, which are communicable diseases, lack of resources and lack of healthcare infrastructure, being associated with the poverty of the region. Data are poor for type 1 and gestational diabetes. However, the lack of knowledge of the cases and the delays in diagnosis, often related to socio-cultural characteristics, leading to chronic and often severe complications. The burden of morbidity and mortality caused by these complications results in unsustainable costs for patients living with diabetes, their families, and society <sup>27</sup>. It is also recognized that elderly patients with diabetes present considerable challenges that need to be addressed with an appropriate management strategy <sup>28</sup>. A major concern is the poor quality of glycemic control, which contributes to an increased risk of early development of diabetic microangiopathy<sup>29</sup>.

#### 4. What are the risk factors for type 2 diabetes in Africa?

Africa shares the same risk factors as the rest of the world. Nevertheless, there are some differences in terms of epigenetic, lifestyle, age, sociocultural considerations, physical inactivity and the environment <sup>30,31</sup>.

In whole published studies, there is an increase in diabetes with age <sup>22</sup>. The unique difference compared to Europe is, as mentioned above, the socioeconomic impacts of earlier and more serious complications of DM <sup>32,33</sup>.

There are some specificities for Africa, such as the socio-cultural, environmental and economic factors <sup>34</sup>.

In the mass screening for T2DM conducted in 2006, the main parameters analyzed were age, sex, BMI, family history of diabetes, hyperglycemia, hyperlipidemia, hypertension, history of macrosomia or gestational diabetes and smoking. All of these factors are significant in the uni-varied analysis, excluding sex and smoking.

In a multivariate model with logistic regression, all the variables introduced are present in the multivariate model, except hyperlipidemia <sup>26</sup>. It is fundamental to consider smoking, that remains a serious issue in overall African countries. The majority

of adult smokers started their first smoking experience very early, prior the age of eighteen. Restricting youth access to cigarettes would be an appropriate strategy to stop smoking epidemic by preventing initiation into tobacco and reducing the number of novel smokers <sup>35</sup>. Studies have indicated that the risk of developing T2DM with smoking is increased and may decrease to the level of a never smoker after 10 years of smoking cessation<sup>36</sup>. In addition, smoking increases cardiovascular risk in all its forms in people with diabetes and the American Diabetes Association recommends that all patients with diabetes should be advised not to use cigarettes and/or e-cigarettes (Class A recommendation) and, after identifying tobacco or electronic cigarette use, include smoking cessation counseling and other forms of treatment as part of routine diabetes care (Class A recommendation) <sup>37</sup>.

Obesity is a major risk factor for developing T2DM. In Africa, a study conducted by the African Obesity Group, based on data from 245 population surveys (1.2 million participants) for BMI and 76 surveys (182,000 participants) from 1998 to 2014, showed that the age-standardized mean BMI increased from 21.9 kg/m<sup>2</sup> (21.3-22.5) to 24.9 kg/m<sup>2</sup> (24.6-25.1) in women and from 21.0 kg/m<sup>2</sup> (95% CI: 20.3-21.7) to 23.0 kg/m<sup>2</sup> (22.7-23.3) in men. The age-standardized prevalence of diabetes increased from 3.4% (1.5-6.3) to 8.5% (6.5-10.8) in men and from 4.1% (2.0-7.5) to 8.9% (6.9-11.2) in women. The most important sources for the later data are for BMI, South Africa (n=17), Nigeria (n=15) and Egypt (n=13); and for diabetes estimates, Tanzania (n=8), Tunisia (n=7), and Cameroon, Egypt and South Africa (together n=6) <sup>38</sup>. It is also not insignificant in Algeria. Several studies found the following prevalence: 15.3% in Algiers <sup>39</sup>, 21.2% (national TAHINA survey) <sup>40</sup>, 19.1% in Tlemcen <sup>41</sup> and 17.9% in Setif <sup>42</sup>. In all of these surveys there was a female dominance for obesity and a male dominance for overweight.

An additional determinant in parts of Africa is the impact of HIV/AIDS on projected estimates of diabetes prevalence <sup>32</sup>.

"The thrifty gene hypothesis has been implicated in the genesis of obesity and T2DM in some populations and sub-populations. Diabetes being caused by "economic genes" adapted specifically for intermittent starvation, a more complex theory of several related diseases such as obesity and hypertension being caused by physiological systems adapted to an older environment pushed beyond their limits by environmental changes. Thus, one alternative is to modify the lifestyle to mimic that of the ancestral environment. More recently, some scholars have considered this approach to be erroneous, given the complexity of obesity pathogenesis <sup>43,44</sup>.

There is a complexity and numerous interacting factors between T2DM and cardiovascular risk factors, including hereditary characteristics, lifestyle, and environment. Obesity, which is a crucial determinant of T2DM, may be absent in some people with diabetes, and a positive family history is a strong risk factor for developing diabetes and CVD. Recently, several genomic loci that were not previously linked to the pathobiology of these diseases, have been individualized. Unfortunately, few genomic studies have been conducted on African populations <sup>45</sup>. Between 2006 and 2014, most genetic studies have been undertaken in

Egypt and Tunisia (70%) with results of 100 polymorphisms in 57 genes related to T2DM in African populations. The polymorphisms associated with T2DM with overlapping effects on various cardiometabolic targets are ACE, AGRP, eNOS, GSTP1, HSP70-2, MC4R, MTHFR, PHLPP, POL1, TCF7L2 and TNF- $\alpha$  <sup>46</sup>.

The challenges of diabetes are complicated because the diversity of populations with their socio-cultural, historical, environmental and economic characteristics. Women in the Middle East and North Africa possess the highest exposure to metabolic diseases among women worldwide, while men rank as the second highest risk group for metabolic diseases. More than 300 deaths per 100,000 individuals in this region are attributed to metabolic risk compared to the global average of under 250. The sedentary lifestyle of women in particular and unhealthy diet (high calorie diet) remains the main factors <sup>47</sup>.

## 5. Conclusion and what are the recommended strategies?

The prevalence of T2DM, which is quite elevated, encourages us to organize in the short, medium and long term by involving primary, secondary and tertiary prevention policies. The ideal is the implementation of a primary prevention plan, reaching children from an early age with the purpose to fight effectively against obesity. These strategies must be adapted to each country by strengthening epidemiological data and go beyond the findings and proposals of primary and secondary diabetes prevention programs.

Targeted screening with awareness raising among the population and practitioners in order to make it regular and systematic from a determined age (at least 35 years old) and in the presence of risk factors for diabetes.

Implementation of the multi-sectoral plan for chronic non-communicable diseases, which includes the involvement of all authorities in the management and care of diabetes mellitus.

The challenges of human, material and organizational resources must also be resolved. Access to treatment and medication is a key element in the treatment of diabetes <sup>48,49</sup>.

## Limitation of the current review

This review is not exhaustive and has focused particularly on data from the international diabetes federation, WHO and many other national studies and surveys.

What is important to report in this review is to demonstrate the abnormal increase in the prevalence of diabetes in Africa. Also the limitation of the data is largely due to the difficulty of conducting prevalence surveys in many countries.

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